

Appl. No. : 10/566,286
Filed : January 27, 2006

AMENDMENTS TO THE CLAIMS

The listing of claims will replace all prior versions and listings of claims in the application. Applicant has amended Claims 1 and 5-8 in the following, in which added text is underlined and deleted text is stricken through. Applicant has cancelled Claims 2 and 9 and added new Claims 10-14.

1. (Currently Amended) A distance-measurement method of determining a distance between objects, using ultrasonic, the method comprising:

transmitting, from a transmitter, an ultrasonic pulse signal having a specific frequency component maintained for a predetermined period specific frequencies;

receiving, at a receiver distanced from the transmitter, the ultrasonic pulse signal;
and

amplifying the ultrasonic pulse and extracting a specific frequency of the amplified ultrasonic pulse to find an arrival time of a pulse and converting the arrival time into a distance;

wherein the amplifying the ultrasonic pulse and extracting a specific frequency of the amplified ultrasonic pulse to find an arrival time of a pulse and converting the arrival time into a distance includes:

amplifying the received ultrasonic pulse signal to generate an amplified signal;

filtering the amplified signal to generate a filtered signal in which an unnecessary frequency of the amplified signal is removed or weakened;

amplifying the filtered signal again to generate a re-amplified signal;

converting the re-amplified filtered signal into a digital signal; and

extracting the specific frequency from a portion of the converted digital signal that reflects the specific frequency component maintained for the predetermined period through a digital signal processing;

analyzing the extracted portion to determine an arrival time of the ultrasonic signal, using the frequency component; and

determining a distance between the transmitter and the receiver, using the arrival time.

Appl. No. : 10/566,286
Filed : January 27, 2006

2. (Cancelled)

3. (Cancelled)

4. (Cancelled)

5. (Currently Amended) The distance-measurement method as claimed in claim 1, wherein in receiving the ultrasonic pulse, the receiver is moving when receiving the ultrasonic signal a moving object.

6. (Currently Amended) A distance-measurement method of determining a distance between objects using ultrasonic, the method comprising:

transmitting, from a transmitter, an ultrasonic signal having a specific frequency component maintained for a predetermined period;

setting a first receiver for receiving an receiving the ultrasonic pulse signal by a first receiver at a known position distance from the transmitter;

determining a first arrival time of the ultrasonic signal at the first receiver;

setting a second receiver for receiving an receiving the ultrasonic pulse signal by a second receiver at an unknown distance from the transmitter object to be measured;

determining a second arrival time of the ultrasonic signal at the second receiver;

transmitting an ultrasonic pulse having a specific frequency;

amplifying the ultrasonic pulse and extracting specific frequencies of the ultrasonic pulse received at the first receiver to find an arrival time of the ultrasonic pulse received at the first receiver and converting the arrival time into a distance;

transmitting error information related to a difference between the distance obtained based on the ultrasonic pulse received by the first receiver and the known distance to the second receiver; and

allowing the second receiver to correct the velocity of sound based on the error information determining a speed of propagation of the ultrasonic signal using the first arrival time and the known distance; and

determining the unknown distance between the transmitter and the second receiver, using the second arrival time and the speed of propagation of the ultrasonic signal,

wherein the amplifying the ultrasonic pulse and extracting a specific frequency of the amplified ultrasonic pulse to find an arrival time of a pulse and converting the arrival

Appl. No. : 10/566,286
Filed : January 27, 2006

time into a distance includes determining the first arrival time of the ultrasonic signal received by the first receiver comprises:

amplifying the received ultrasonic signal pulse to generate an amplified signal;

filtering the amplified signal to generate a filtered signal in which an unnecessary frequency of the amplified signal is removed or weakened;

amplifying the filtered signal again to generate a re-amplified signal; converting the re-amplified signal into a digital signal; and

converting the filtered signal into a digital signal;

extracting the specific frequency from a portion of the converted digital signal, the extracted portion reflecting the specific frequency component maintained for the predetermined period; and through a digital signal processing;

analyzing the extracted portion to determine the first arrival time.

7. (Currently amended) A distance measurement device for determining a distance using an ultrasonic pulse signal, the device comprising:

a transmitter configured to generate and transmit an ultrasonic pulse signal having a specific frequency component maintained for a predetermined period;

a sensor distanced from the transmitter and configured to receive the ultrasonic pulse signal transmitted from the transmitter;

an amplifier configured to amplify the ultrasonic pulse signal received by the sensor;

an analog filter configured to selectively attenuate other frequencies except for select the specific frequency component from the ultrasonic pulse signal amplified by the amplifier, to thereby generate generating an analog-filtered signal;

a secondary amplifier configured to amplify an analog-filtered signal selected through the analog filter;

an A/D converter configured to convert the amplified analog-filtered signal to a digital data;

a memory configured to store the digital data therein; and

Appl. No. : 10/566,286
Filed : January 27, 2006

a digital signal processor configured to process the digital data stored in the memory to extract a portion reflecting the specific frequency component maintained for the predetermined period,

wherein the digital signal processor is further configured to analyze the extracted portion to determine an arrival time of the ultrasonic signal, and

wherein the digital signal processor is further configured to determine a distance between the transmitter and the sensor, using the arrival time

a transmission time of a first signal transmitted from the transmitter is received and a delayed time of the first signal is measured based on the transmission time and an arrival time of the first signal calculated in the digital signal processor.

8. (Currently amended) The distance measurement device using ultrasonic as claimed in claim 7, further comprising:

an output unit configured to display results processed in the digital signal processor;

a numerical input unit configured to inform the digital signal processor of a processing condition; and

a communication unit configured to connect the digital signal processor and an external apparatus to each other so that the digital signal processor and the external apparatus exchange information.

9. (Cancelled)

10. (New) The method as claims in claim 1, further comprising amplifying the filtered signal again to generate a re-amplified signal, wherein converting the filtered signal into a digital signal comprises converting the re-amplified signal into a digital signal.

11. (New) The method as claims in claim 1, wherein extracting the portion of the converted digital signal comprises performing a convolution operation on the converted digital signal.

12. (New) The method as claimed in claim 1, wherein analyzing the extracted portion comprises determining a starting time of the extracted portion, and wherein the starting time is indicative of the arrival time of the ultrasonic signal.

Appl. No. : 10/566,286
Filed : January 27, 2006

13. (New) The method as claimed in claim 1, wherein determining the distance comprises:

determining a duration between the arrival time and a transmission time, wherein the transmission time is when the ultrasonic signal is transmitted from the transmitter; and multiplying the duration with a speed of the ultrasonic signal.

14. (New) The method as claimed in claim 1, wherein the specific frequency component comprises a predetermined waveform repeated in a predetermined number within the extended period of time.